

**NESHAMINY INTERCEPTOR EVALUATION
FOR
MUNICIPAL 537 PLANNING IN LOWER BUCKS COUNTY**

March 2015
(Revised September 2015)
(Last Revised January 2016)

I. PURPOSE

The Bucks County Water and Sewer Authority (BCWSA) provides sanitary sewer conveyance service to Lower Bucks County municipalities along the Neshaminy Creek between Newtown Township and Bensalem Township. Treatment plant capacity is also provided by BCWSA through an agreement with the City of Philadelphia Water Department.

A Settlement Agreement between BCWSA and the Pennsylvania Department of Environmental Protection (PADEP) included the establishment of a Corrective Action Plan (NICAP) and Connection Management Plan (NICMP) for the Neshaminy Interceptor and which included the requirement for tributary municipalities to complete updates to their Municipal 537 Plans, prepare a Sewer System Needs Analysis for their communities and complete a comprehensive inflow and infiltration (I/I) evaluation for their sanitary sewer systems.

This Interceptor evaluation will characterize the current flow conditions in the Neshaminy Interceptor and project conditions as a result of the municipal forecasted needs. This analysis will also consider the effects of reduction of infiltration and inflow from municipal sewer systems completed in conformance with the NICAP/NICMP and Supplemental Agreements which include flow limits for all tributary municipalities to the Neshaminy Interceptor. The original Evaluation (dated March 2015) utilized limits which mirrored the flow limits contained in the BCWSA Agreement with the City of Philadelphia. The September 2015 Evaluation utilized limits in accordance with DEP design standards, although the limits contained in the BCWSA Agreement with the City of Philadelphia still apply to penalties and fines (see individual supplementary agreements between BCWSA and municipalities for specific language). This version of the Evaluation (January 2016) revises Tables 1 and 3 of the report, as well as the Recommended Alternative. Additional lining of the 42"/48" Interceptor and a relief sewer of the 54" Interceptor has been included.

It is expected that the results of this evaluation will be incorporated into the individual municipal 537 Plan Updates, to complete the evaluation of sewer facilities necessary to serve the future needs.

II. BACKGROUND

The Authority provides sewage conveyance services to a large portion of Lower Bucks County by means of the Neshaminy Interceptor sewer, the main pump station at Totem Road, and the force main to the City of Philadelphia. The Neshaminy Interceptor begins in Newtown Township and proceeds down the Neshaminy Creek Valley for a distance of 14 miles where the Interceptor terminates at the Totem Road Pump Station in Bensalem Township. The Interceptor begins as a 12-inch diameter sewer, increasing in size up to 84-inch diameter as it picks up sewage from various gravity collection sewers, branch interceptors and force mains. The Core Creek Interceptor, a major branch of the Neshaminy Interceptor, extends the service area into Lower Makefield Township.

The Totem Road Pumping Station lifts sewage from the Neshaminy Interceptor and pumps it through parallel 36-inch and 42-inch diameter force mains to Philadelphia. The parallel force mains extend 27,000 feet to their point of terminus on Grant Avenue in Philadelphia. The force mains are combined into a single 42-inch force main at Grant Avenue and extend an additional 21,000 feet, where flows are discharged into the City of Philadelphia's Delaware Interceptor at Rhawn Street which conveys the flows to the Northeast Philadelphia Water Pollution Control Plant for treatment. The Authority owns 24 million gallons per day (MGD) capacity in the Northeast Plant for the Neshaminy Interceptor Service Area. The City of Philadelphia's maximum daily flow limit is 33 MGD and the peak instantaneous flow limit is 48 MGD. The average flow from the Neshaminy Interceptor Service Area for Year 2014 was 18.64 MGD.

The Neshaminy Interceptor Service Area provides wholesale sanitary sewer service to portions of the following municipalities: Bristol Township, Falls Township, Hulmeville Borough, Langhorne Manor Borough, Lower Makefield Township, Lower Southampton Township, Newtown Borough, Newtown Township, Northampton Township and Penndel Borough.

The Neshaminy Interceptor also provides retail sanitary sewer service to portions of the following municipalities: Bensalem Township, Langhorne Borough and Middletown Township.

III. PREVIOUS PLANNING, PERMITTING AND AGREEMENTS

A. Planning

Lower Bucks County 201 Facilities Plan: Completed in October 1985, this plan called for the conveyance of Neshaminy Interceptor flows to the Philadelphia Northeast Water Control Plant (NEWCP) including upgrades to the NEWCP plant, the Totem Road Pumping Station (to 60 mgd) and the extension of and paralleling of existing Force Mains.

Relief of 18 inch Neshaminy Interceptor (between Newtown Creek and Core Creek): Planning for this project was completed in approximately May 1988 for the construction of a relief sewer through Middletown Township to convey projected future sanitary sewer flows from Newtown Borough and Township and a portion of Northampton Township.

Lower Bucks Comprehensive Sewerage Plan: Completed in October 1988, this report updated the 201 Facilities Plan to include the phase out of the Newtown-Bucks County Joint Municipal Authority's Wastewater Treatment Plant (WWTP), the phase out of the Penndel Municipal Authority WWTP and phase out of the Falls Municipal Authority's WWTP. All flows from these 3 plants were to be sent through the Neshaminy Interceptor and via the replacement Totem Road Pumping Station and Force Mains to the NEWCP.

B. Agreements

1987 PWD Agreement

This agreement provided for the upgrade of the Totem Road Pumping Station and the extension of the force main further into the City. Treatment capacity was increased to an average of 20 mgd with a peak instantaneous flow of 40 mgd.

1996 PWD Agreement

This agreement provided for a temporary “rental” of average annual flow capacity as a result of an exceedance of the 20 mgd flow limit based on a 365 day rolling average basis.

2005 PWD Amendment (III) to Agreement

This agreement increased the average annual capacity at the NEWCP to 24 mgd and the peak instantaneous flow limit to 48 mgd. It also established a maximum daily flow limit of 33 mgd. This resolved a moratorium placed on the Neshaminy Interceptor Service Area in Year 2004, due to exceedance of the average annual flow in Spring 2003.

DEP Settlement Agreement

This agreement established a Corrective Action Plan and Connection Management Plan for all municipalities tributary to the Neshaminy Interceptor and included requirements for Supplemental Municipal Agreements containing flow limits, Municipal 537 Planning Updates, Comprehensive Infiltration and Inflow Evaluation of sanitary sewer systems and removal of excessive wet weather flows.

Supplemental Municipal Agreements

These agreements were to be completed by March 31, 2015. Flow limits were established using 5 year historical average flows from tributary municipalities and maximum day and peak instantaneous flow limits reflecting the factors used to establish the flow limits in the PWD Amendment III Agreement.

IV. NESHAMINY INTERCEPTOR EVALUATION – COMPUTER MODELING

A. Introduction

The portion of the Neshaminy Interceptor from the connection of the Core Creek Interceptor down to the Totem Road Pump Station has been modeled using Bentley SewerCAD V8i. This portion of the Interceptor consists of 30”, 33”, 36”, 42”, 48”, 54”, 60”, 72” and 84” diameter reinforced concrete pipe, with the majority of the Interceptor being installed in the mid to late 1960’s. See FIGURE A for a plan showing this portion of the Interceptor.

The portion of the Neshaminy Interceptor above the Core Creek Interceptor was not included in this model, since that portion was paralleled in Year 1988 with 30” pipe. The purpose of this model was to evaluate the Neshaminy Interceptor to convey existing flows with anticipated Inflow and Infiltration (I&I) reductions to achieve future flow limits and determine the best course of action to provide the necessary capacity for future municipal needs.

B. Modeling Calibration

For calibration purposes, the model was initially set up using the actual hourly flows recorded at each customer meter connecting to the Interceptor during a December 26, 2009 storm event. This was the storm used for the preliminary design of the Neshaminy Interceptor Surge Tank, which has not been constructed. The storm produced 2.16" of rain according to the Northeast Philadelphia Airport rain gauge, with additional snow melt caused by the estimated 2 to 4 inches of snow already on the ground surface at the time of the rain. The results were compared to the meter data from the nine (9) "N" meters that the Authority has installed in the Neshaminy Interceptor, and appropriate adjustments were made to the model to match observed conditions.

C. Existing Flow Conditions

The Totem Road Pump Station, which receives all the flows from the Neshaminy Interceptor and conveys them to the City of Philadelphia's Northeast Water Pollution Control Plant, is limited by agreement to 2 times the average daily flow. Based on a purchased average daily flow of 24 MGD, the peak limit is 48 MGD. For this reason, the original model scenario used the average flow from each customer meter, multiplied by a factor of 2.0 to arrive at the peak flow that connection would contribute to the Interceptor. Per DEP design requirements, the average flow from each customer meter is now multiplied by a factor of 2.5 to arrive at the peak instantaneous flow that connection would contribute to the Interceptor. An average daily hydrograph was developed for each customer meter using actual flows from a period of time during October 2009, in order to develop a flow pattern for each connection. The hydrographs were then converted to the 5-year average flow (2010-2014) for each customer meter, and peaked by a factor of 2.5, which represents the peak instantaneous limit established for Municipal customer systems in this Evaluation.

Table 1 (below) presents the 5-year average flow from each customer, the 5-year average flow reduced by 10% to account for peak flow reduction, the metered peak flow during the December 26, 2009 wet weather event, the customer peak limit based on a factor of 2.0 times the 5-year average flow (PWD Allowable Peak), and the customer peak instantaneous limit based on a factor of 2.5 times the 5-year average flow.

The assumed 10% reduction was used for the sole purpose of evaluating the initial phase of Neshaminy Interceptor improvements. It is expected that as a result of reducing peak flows to 2.5, average flows will be reduced as well. We have estimated 10%, but it could be more or less. If the average flow does not reduce by 10%, but the peak hour ratio is 2.5 or less, no enforcement action needs to be taken as long as Neshaminy Interceptor flows do not exceed the COP limits, or do not cause surcharging in the Interceptor.

TABLE 1

Customer	Avg. Daily Flow (ADF) (2010-2014)	ADF Reduced by 10% (via peak flow redux)	Metered Peak Instant Flow (12/26/09)	PWD Allowed Peak Flow 2 x ADF (peak hour)	Design Peak Flow 2.5 x ADF (peak 15-minute)
	(mgd)	(mgd)	(mgd)	(mgd)	(mgd)
Bensalem Township	4.46	4.01	15.22	8.03	10.03
Hulmeville Borough	0.07	0.07	0.45	0.13	0.17
Langhorne Borough	0.39	0.35	1.58	0.70	0.88
Langhorne Manor Borough	0.04	0.03	0.14	0.07	0.08
Lower Makefield Township	0.72	0.65	1.83	1.30	1.63
Newtown Township/Boro	1.97	1.78	3.80	3.55	4.44
Lower Southampton Township	0.49	0.44	1.21	0.88	1.10
Northampton Township	3.73	3.36	8.82	6.72	8.40
Middletown Township	3.58	3.23	9.90	6.45	8.06
George School	0.07	0.07	0.31	0.13	0.17
Core Creek Park	0.002	0.002	n/a	0.00	0.00
Korman Corporation	0.03	0.02	0.09	0.05	0.06
Penndel Borough	0.26	0.23	1.17	0.47	0.58
Falls Township	2.73	2.46	6.76	4.92	6.15
Bristol Township	0.15	0.13	0.85	0.26	0.33
TOTAL	18.71	16.84	--	--	--
Totem Road PS (attenuated)	18.09		54.00	--	--
PWD Agreement Limits	24.00		--	48.00	--

D. Future Flows

Each customer was to provide the Authority with their ultimate future needs, so that any planned improvements to the Interceptor would be adequately designed. Subsequent to the original evaluation in March 2015, each customer was to provide specific 10-year future needs projections in addition to estimated 10-year I&I flows to be removed from their systems. To date, most of the 10-year projections have been received. Not all municipalities provided 10-year estimated I&I Removal.

Future flows used in this evaluation are estimates and do not reflect a specific allocation to any municipality. Future flow capacity will be allocated to municipalities on a “first come, first serve” basis through the DEP planning process. Act 537 planning application processing will be dependent on actual flow quantities as measured at the PWD sewer connection, established municipal flow targets, and flow triggers established in this evaluation.

In order to proceed with the modeling, 10-year future flows were estimated based on a straight-line basis (10-year/25-year = 40%). The majority of the ultimate future needs received from the customers were generally noted to be 25-year projections. Table 2 (see below) summarizes the 10-year projections provided by the municipalities compared to the projections used in the model.

TABLE 2

	10-Year Add'l Future Average Flow [per updated customer projections]	10-Year Add'l Future Average Flow [based on straight-line basis]
Customer	(mgd)	(mgd)
Bensalem Township [a]	0.68	0.39
Hulmeville Borough	0.02	0.01
Langhorne Borough	0.03	0.02
Langhorne Manor Borough	0.002	0.002
Lower Makefield Township	0.22	0.16
Newtown Township/Boro	0.36	0.18
Lower Southampton Township	0.06	0.03
Northampton Township	0.29	0.13
Middletown Township	0.22	0.20
George School	0.00	0.00
Core Creek Park	0.00	0.00
Korman Corporation	0.00	0.00
Penndel Borough [b]	0.06	0.06
Falls Township	0.02	0.03
Bristol Township [b]	0.04	0.04
TOTAL	2.00	1.24

[a] 0.17 mgd (ADF) of future flow enters one run above TRPS, which does not have hydraulic issues.

[b] Specific 10-year projection was not provided, so 40% of ultimate projection was used in both columns.

The future flows were added to the existing flow scenario (2.5xADF) described in Paragraph C above. Future flows were calculated at the Authority standard of 250 GPD/EDU. They were peaked by a factor of 2.5. A standard hydrograph was developed for all future flows, no matter which municipality they are associated with.

The intent is to make improvements to the Neshaminy Interceptor to satisfy the 10-year future needs. The improvements are contingent upon customers removing I&I from their systems. Flow triggers will be put in place, so that if the tributary municipalities are unable to remove the required I&I or if the rate/timing of future connections are higher/faster than anticipated, additional Interceptor improvements may go into effect, depending on the circumstances.

Table 3 (below) presents the additional future peak flow projections for each customer (multiplied by a factor of 2.5) and the projected future peak flow if adding the additional future flow to the “2.5xADF” flow (with I&I removal).

TABLE 3

	10-Year Add'l Future Peak Flow*	10-Year Projected Future Peak Instant Flow** (10-Yr Future + 2.5xADF)
Customer	(mgd)	(mgd)
Bensalem Township	0.97	11.01
Hulmeville Borough	0.02	0.19
Langhorne Borough	0.05	0.93
Langhorne Manor Borough	0.01	0.09
Lower Makefield Township	0.40	2.03
Newtown Township/Boro	0.45	4.89
Lower Southampton Township	0.07	1.18
Northampton Township	0.32	8.72
Middletown Township	0.49	8.55
George School	0.00	0.17
Core Creek Park	0.00	0.00
Korman Corporation	0.00	0.06
Penndel Borough	0.14	0.72
Falls Township	0.07	6.22
Bristol Township	0.11	0.44
TOTAL	3.10	--
Totem Road PS (attenuated)	--	39.30

* Calculated at "Ultimate Future Avg Flow" x 0.4 (40% Straight-line Basis) x 2.5 (Peak Factor)

** With I&I removed from the systems (and subsequent 10% reduction to ADF)

E. Model Results

1. Existing Average Flow and a Peak Factor of 2.5: In this scenario, the hydraulic design capacity of the Interceptor is exceeded, beginning midway through the 48" pipe and continuing up to the 30" Interceptor. The modeled flow at Totem Road Pump Station was calculated to be 40.46 MGD, which is below the 48 MGD peak limit imposed by the City of Philadelphia.
2. 10-Year Future Flow Conditions: The addition of future flow to the 2.5xADF scenario will only increase the pipe capacity exceedances in the Interceptor. The Interceptor's surcharged and pressurized state under the Future Flow Conditions is not acceptable.

The following Upgrade Alternatives were considered:

- a. Lining of the 30", 33", 36" and 42" portions of the Interceptor plus lining the first 3,000 feet of 48" Interceptor plus construction of a relief sewer along the 54" portion of the Interceptor

All Alternatives rely on municipal customers reducing their peak instantaneous flows to 2.5 times their average flow. By reducing peak flows, a corresponding reduction to existing flows should occur. For purposes of this evaluation, it is estimated that average flows will reduce by 10%.

This alternative (including the reduction in average daily flow by 10%) would reduce the hydraulic grade line (HGL) to within top of sewer pipe for existing and future flows at a peaking factor of 2.5. The estimated cost for this Alternative is \$18,173,000. The detailed cost estimate is included in Figure B.

- b. Upgrading the size of the 30", 33", 36" and 42" portions of the Interceptor plus construction of a relief sewer along the 54" portion of the Interceptor

This alternative would reduce the HGL to within the sewer pipe. The estimated cost for this alternative is \$24,206,000. The detailed cost estimate is included in Figure C.

F. Alternative Analysis

The following types of improvements to the Neshaminy Interceptor were considered for this evaluation:

1. Removal and Replacement of the Existing Sewer with Larger Diameter Pipe:

- a. Advantages: The replacement pipe size can be increased to provide a surplus capacity in the design; any infiltration presently in the existing Interceptor piping will be removed; all excavations should be limited to the original trench of the pipe, thus eliminating rock excavation.
- b. Disadvantages: Bypass pumping is required; significant surface disturbance will be sustained, especially with the larger diameter pipes and the deeper pipes; dewatering and environmental concerns would arise due to the close proximity to the Creek.

2. Installing a Relief Sewer alongside the Existing Interceptor:

- a. Advantages: Bypass pumping can be avoided; excavations can be slightly shallower.
- b. Disadvantages: Additional easements would likely be required; structures built in the vicinity of the Interceptor could inhibit the installation of a parallel sewer line in many cases; the existing Interceptor would remain in service, but its condition would not be improved in any way; rock excavation would likely be substantial; significant surface disturbance would still be encountered.

Conclusion on Relief Sewers - Due to the list of negative aspects with a relief sewer, cost estimates for this type of alternative to improve the entire Interceptor were not prepared.

3. Lining the Existing Interceptor:

- a. Advantages: Minimal excavations (only around certain manholes to temporarily remove the cone sections); minimal surface disturbance; avoid excavations in steep banks of the Creek, which would be very difficult to stabilize after construction; rehabilitate the existing infrastructure and extend its service life; increased smoothness in the pipe, which in turn decreases the friction losses; removal of any infiltration in the existing pipe.
- b. Disadvantages: Bypass pumping is required; slight decrease in pipe diameter, which is more than offset by the increase in smoothness of the pipe.

G. **Recommendations**

Lining of the 30", 33", 36" and 42" portions of the Interceptor plus lining the first 3,000 feet of 48" Interceptor plus construction of a relief sewer along the 54" portion of the Interceptor at an estimated cost of \$18,173,000.

Since this upgrade is based on significant I/I reductions, these modeled conditions could take some time to achieve and would need to be maintained in order to accommodate future flows. Connection limitations to Municipal customers who do not achieve the necessary reductions may be necessary.

H. Flow Triggers

1. Should the tributary municipalities be unable to remove the required I&I or if the rate/timing of future connections are higher/faster than anticipated, additional Interceptor improvements may go into effect, or connection restrictions put in place for municipalities which exceed their flow limits.
2. The existing 5-year average flow (2010-2014), as measured at Totem Road Pump Station, is 18.09 MGD. Should the 5-year historic average flow (to be recalculated on an annual basis) surpass 19.00 MGD, the following steps will be taken:
 - a. Evaluate the maximum day and peak flows to the City of Philadelphia (via Totem Road Pump Station) and determine if peak factors have been reduced.
 - b. Consider sewer connection moratoriums (to be determined by customer metered flow evaluations and compliance with Supplementary Agreements).
 - c. Consider further improvements to the Interceptor.

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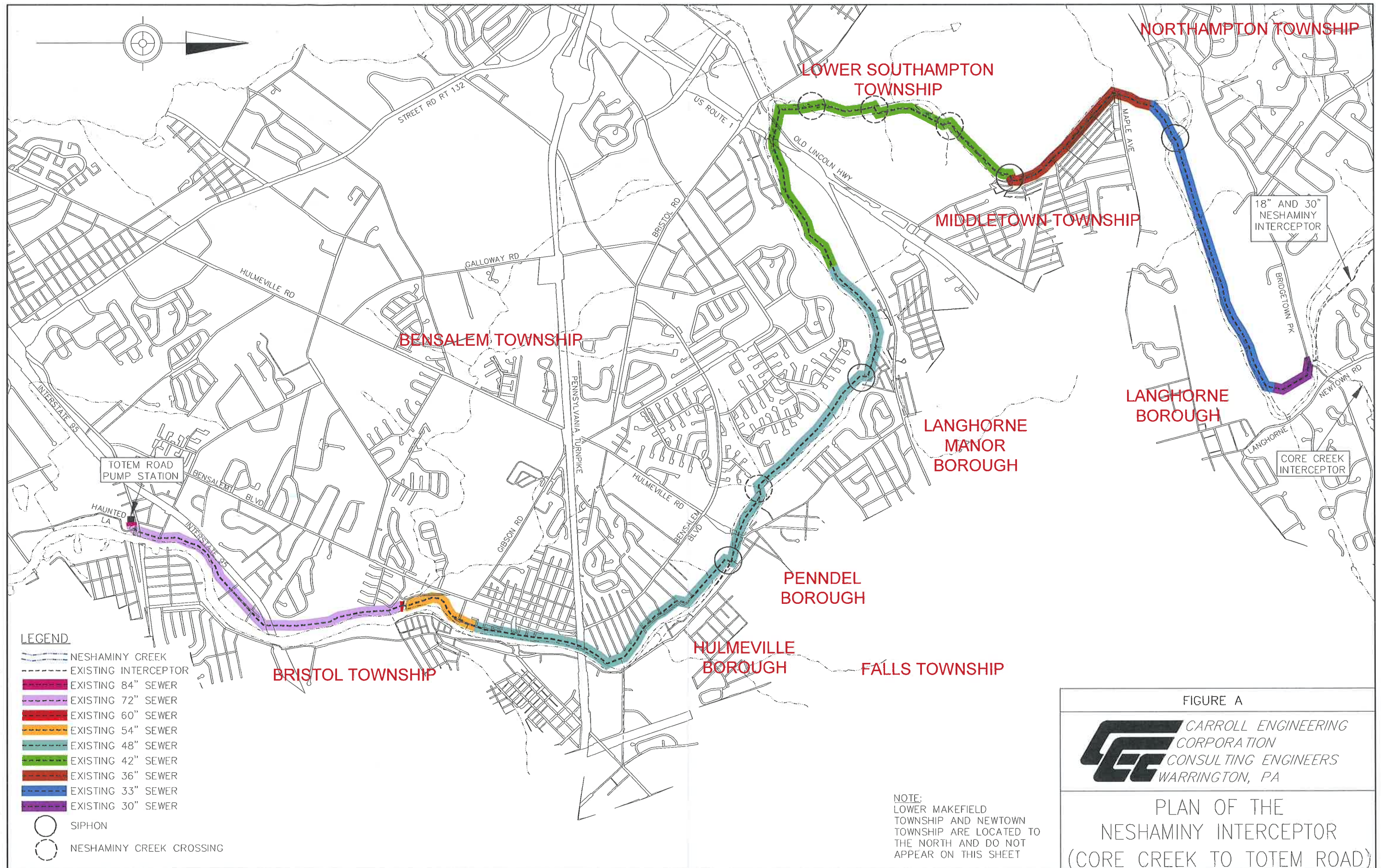


FIGURE B

OPINION OF PROBABLE CONSTRUCTION COST
LINING EXISTING 30", 33", 36", 42" AND FIRST 3,000' +/- OF 48" NESHAMINY INTERCEPTOR SEWER
PLUS RELIEF SEWER OF 54" NESHAMINY INTERCEPTOR SEWER
PREPARED JANUARY 2016

NO.	LINING PROJECT ITEM	UNITS	QUANTITY	UNIT PRICE	TOTAL PRICE
1	30" Liner	LF	1,730	\$ 220.00	\$ 380,600.00
2	33" Liner	LF	8,748	\$ 250.00	\$ 2,187,000.00
3	36" Liner	LF	5,406	\$ 270.00	\$ 1,459,600.00
4	42" Liner	LF	13,692	\$ 300.00	\$ 4,107,600.00
5	48" Liner	LF	3,089	\$ 320.00	\$ 988,500.00
6	Cleaning Sewer	LF	32,665	\$ 2.00	\$ 65,300.00
7	Removal of Existing MH Top Section (<10' deep)	EA	50	\$ 2,300.00	\$ 115,000.00
8	Replace Top Section of MH (<10' deep)	EA	50	\$ 5,425.00	\$ 271,300.00
9	Clearing (assume entire easement, for access to each lining setup)	Acre	17	\$ 14,700.00	\$ 253,800.00
10	Erosion and Sedimentation Controls	LF	32,665	\$ 5.00	\$ 163,300.00
11	TV Inspection	LF	32,665	\$ 1.00	\$ 32,700.00
12	Restoration and Seeding (exclude paved areas)	LF	29,571	\$ 6.00	\$ 177,400.00
13	Estimated Monthly Bypass Equipment Rent	Month	3.8	\$ 65,500.00	\$ 248,900.00
14	Relocate/Reset Bypass Piping	EA	17	\$ 5,000.00	\$ 85,000.00
15	Watchman for overnight and weekends	LS	1	\$ 293,000.00	\$ 293,000.00
16	Fuel for Bypass Pumps	Days	110	\$ 650.00	\$ 71,500.00
17	Bypass Delivery/Pickup	LS	1	\$ 12,000.00	\$ 12,000.00
18	Pre/Post Construction Video	LS	1	\$ 15,000.00	\$ 15,000.00
19	Bonds & Insurance (2%)	LS	1	\$ 218,600.00	\$ 218,600.00
20	Mobilization (2%)	LS	1	\$ 218,600.00	\$ 218,600.00
Construction Subtotal					\$ 11,364,700.00
Contingency (25%)					\$ 2,841,200.00
Construction Total					\$ 14,205,900.00
25% Soft Costs (Engineering, Legal, Administration)					\$ 2,841,200.00
TOTAL LINING PROJECT COST (ROUNDED)					\$ 17,048,000.00

NO.	54" RELIEF SEWER PROJECT ITEM	UNITS	QUANTITY	UNIT PRICE	TOTAL PRICE
1	24"/36" PVC Gravity Sewer	LF	2,100	\$ 90.00	\$ 189,000.00
2	Stone Bedding	CY	960	\$ 60.00	\$ 57,600.00
3	Soil Excavation	CY	3,700	\$ 5.50	\$ 20,350.00
4	Rock Excavation (depth estimated)	CY	2,200	\$ 75.00	\$ 165,000.00
5	Suitable Backfill (with compaction)	CY	4,400	\$ 5.00	\$ 22,000.00
6	Clean Fill Imported to Site	CY	750	\$ 20.00	\$ 15,000.00
7	Hauling Excess Material	CY	2,200	\$ 10.00	\$ 22,000.00
8	6' Diameter MH (10'-15' deep)	EA	4	\$ 11,600.00	\$ 46,400.00
9	6' Diameter MH (10'-15' deep) - Doghouse	EA	1	\$ 15,000.00	\$ 15,000.00
10	6' Diameter MH (15'-20' deep)	EA	1	\$ 19,500.00	\$ 19,500.00
11	6' Diameter MH (>20' deep)	EA	1	\$ 25,350.00	\$ 25,350.00
12	Core Drill Existing Manholes for Connection	EA	2	\$ 3,000.00	\$ 6,000.00
13	Small Stream Crossing	LS	1	\$ 20,000.00	\$ 20,000.00
14	Clearing	Acre	2	\$ 13,000.00	\$ 27,695.13
15	Erosion and Sedimentation Controls	LF	2,100	\$ 5.00	\$ 10,500.00
16	TV Inspection	LF	2,100	\$ 1.00	\$ 2,100.00
17	Pipe Testing	LF	2,100	\$ 2.00	\$ 4,200.00
18	Restoration and Seeding	LF	2,100	\$ 6.00	\$ 12,600.00
19	Estimated Monthly Bypass Equipment Rent (<72" Portion)	Month	0	\$ 80,000.00	\$ 13,600.00
20	Bypass Delivery/Pickup	LS	1	\$ 4,000.00	\$ 4,000.00
21	Dewatering (200' well point system)	Days	30	\$ 600.00	\$ 18,000.00
22	Pre/Post Construction Video	LS	1	\$ 5,000.00	\$ 5,000.00
23	Bonds & Insurance (2%)	LS	1	\$ 14,500.00	\$ 14,500.00
24	Mobilization (2%)	LS	1	\$ 14,500.00	\$ 14,500.00
Construction Subtotal					\$ 749,895.13
Contingency (25%)					\$ 187,500.00
Construction Total					\$ 937,395.13
25% Soft Costs (Engineering, Legal, Administration)					\$ 187,500.00
TOTAL RELIEF SEWER PROJECT COST (ROUNDED)					\$ 1,125,000.00
GRAND TOTAL PROJECT COST (ROUNDED)					\$ 18,173,000.00

FIGURE C

**OPINION OF PROBABLE CONSTRUCTION COST
REMOVE AND REPLACE EXISTING 30", 33", 36" & 42" NESHAMINY INTERCEPTOR SEWER
PLUS RELIEF SEWER OF 54" NESHAMINY INTERCEPTOR SEWER
PREPARED JANUARY 2016**

NO.	ITEM	UNITS	QUANTITY	UNIT PRICE	TOTAL PRICE
1	36" (PVC)	LF	1,730	\$ 79.00	\$ 136,700.00
2	42" (PVC)	LF	14,154	\$ 96.00	\$ 1,358,800.00
3	48" (PVC)	LF	13,692	\$ 117.00	\$ 1,602,000.00
4	Excavation (reuse material)	CY	98,185	\$ 6.00	\$ 589,100.00
5	Hauling Excess Material	CY	40,011	\$ 11.70	\$ 468,100.00
6	Suitable Backfill (with compaction)	CY	66,707	\$ 6.00	\$ 400,200.00
7	Stone Bedding	CY	24,421	\$ 62.00	\$ 1,514,100.00
8	Removal of Existing Sewer Pipe (30"-36")	LF	15,884	\$ 45.00	\$ 714,800.00
9	Removal of Existing Sewer Pipe (42")	LF	13,692	\$ 57.00	\$ 780,400.00
10	Disposal of Removed Pipe	Ton	9,713	\$ 81.00	\$ 786,700.00
11	6' Diameter MH (<10' deep)	EA	22	\$ 8,500.00	\$ 187,000.00
12	6' Diameter MH (10'-15' deep)	EA	27	\$ 13,100.00	\$ 353,700.00
13	6' Diameter MH (15'-20' deep)	EA	13	\$ 22,100.00	\$ 287,300.00
14	6' Diameter MH (>20' deep)	EA	3	\$ 28,700.00	\$ 86,100.00
15	Removal of Existing MH (<10' deep)	EA	22	\$ 2,300.00	\$ 50,600.00
16	Removal of Existing MH (10'-15' deep)	EA	27	\$ 3,200.00	\$ 86,400.00
17	Removal of Existing MH (15'-20' deep)	EA	13	\$ 4,300.00	\$ 55,900.00
18	Removal of Existing MH (>20' deep)	EA	3	\$ 5,300.00	\$ 15,900.00
19	Longitudinal Road Work (incl. traffic control, repaving, stone)	LF	2,580	\$ 215.00	\$ 554,700.00
20	Neshaminy Creek Crossings (non-siphons) - Three Total	LF	1,134	\$ 226.00	\$ 256,300.00
21	Small Stream Crossings	EA	2	\$ 11,300.00	\$ 22,600.00
22	Jack and Bore (Route 1, 60" Casing Pipe)	LF	200	\$ 850.00	\$ 170,000.00
23	Jack and Bore (Old Lincoln Hwy, 60" Casing Pipe)	LF	100	\$ 850.00	\$ 85,000.00
24	Boring Pits (incl. dewatering and excavation/backfill)	EA	4	\$ 11,300.00	\$ 45,200.00
25	Clearing	Acre	16	\$ 14,700.00	\$ 228,500.00
26	Erosion and Sedimentation Controls	LF	29,576	\$ 5.00	\$ 147,900.00
27	TV Inspection	LF	29,576	\$ 1.00	\$ 29,600.00
28	Pipe Testing	LF	29,576	\$ 2.00	\$ 59,200.00
29	Restoration and Seeding	LF	26,482	\$ 6.00	\$ 158,900.00
30	Estimated Monthly Bypass Equipment Rent	Month	18	\$ 65,500.00	\$ 1,179,000.00
31	Relocate/Reset Bypass Piping	EA	15	\$ 5,000.00	\$ 75,000.00
32	Watchman for overnight and weekends	LS	1	\$ 1,629,000.00	\$ 1,629,000.00
33	Fuel for Bypass Pumps	Days	500	\$ 650.00	\$ 325,000.00
34	Bypass Delivery/Pickup	LS	1	\$ 6,000.00	\$ 6,000.00
35	Dewatering (200' well point system)	Days	500	\$ 680.00	\$ 340,000.00
36	Pre/Post Construction Video	LS	1	\$ 10,000.00	\$ 10,000.00
37	Bonds & Insurance (2%)	LS	1	\$ 295,900.00	\$ 295,900.00
38	Mobilization (2%)	LS	1	\$ 295,900.00	\$ 295,900.00
Construction Subtotal					\$ 15,387,500.00
Contingency (25%)					\$ 3,846,900.00
Construction Total					\$ 19,234,400.00
25% Soft Costs (Engineering, Legal, Administration)					\$ 3,846,900.00
TOTAL REPLACEMENT PROJECT COST (ROUNDED)					\$ 23,081,000.00
TOTAL RELIEF SEWER PROJECT COST (ROUNDED) [from Figure B]					\$ 1,125,000.00
GRAND TOTAL PROJECT COST (ROUNDED)					\$ 24,206,000.00